

A NEW SPECIES OF *CENTISTES* FROM BRAZIL
(HYMENOPTERA: BRACONIDAE: EUPHORINAE) PARASITIZING
ADULTS OF *DIABROTICA* (COLEOPTERA: CHRYSOMELIDAE),
WITH A KEY TO NEW WORLD SPECIES

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Abstract.—A new species of euphorine braconid, *Centistes gasseni* Shaw from Brazil is described, diagnosed, and illustrated. This species is a koinobiont endoparasitoid of the adult stage of *Diabrotica*, and is currently being studied as a possible biocontrol agent for the *Diabrotica* pest-complex including the southern corn rootworm in North America. An identification key for the known *Centistes* species in the New World region is included. Three species, *C. agilis* (Cresson), *C. claripennis* (Ashmead), and *C. laevis* (Cresson) are newly recorded as occurring in Wyoming, representing new far western distribution records for these species.

Key Words: Braconidae, Euphorinae, Centistini, neotropical, biological control

The purpose of this paper is to describe a new species of *Centistes* parasitizing *Diabrotica* that was recently discovered in Passo Fundo, Rio Grande do Sul, Brazil. The new *Centistes* was reared from *Diabrotica speciosa* (Germar) in 1992 by Dirceu N. Gassen, of EMBRAPA-CNPT, Passo Fundo, working in collaboration with Robert F. W. Schroder, USDA-ARS, Insect Biocontrol Laboratory, Beltsville, Maryland. It is currently being studied by Dr. Schroder as a possible biocontrol agent for the *Diabrotica* pest-complex including the southern corn rootworm, *Diabrotica undecimpunctata howardi* Barber. *D. undecimpunctata* is a serious pest of corn and cucurbits in the southern United States, and *Diabrotica speciosa* is increasingly becoming a problem in Brazil. The new *Centistes* was imported to the United States in 1992 and has been successfully raised from *D. undecimpunctata* at the Maryland Department of Agriculture quarantine facility in Annapolis. A permit

was recently obtained for laboratory studies at the Beltsville Agriculture Research Center. Consequently, providing a scientific name for this species is critical at this point in time.

The genus *Centistes* is the most diversified lineage of the euphorine tribe Centistini (Shaw 1985). The Centistini can be most easily diagnosed by the broad first metasomal tergum with spiracles very near the front of the segment (Fig. 13) and the very smooth fused tergum 2 + 3 without a lateral fold or crease (Fig. 12). *Centistes* are the most common members of the centistine lineage with an extremely short, broad, and densely setose ovipositor sheath (Figs. 15, 16). A less obvious, but phylogenetically significant, character is the extreme reduction or complete absence of vein M beyond the Rs in *Centistes*. The genus is essentially worldwide in distribution, except for the Australian continent. Most of the described species are holarctic in distribution, but that

is probably only an artifact of poor sampling and lack of taxonomic revisions in the tropics. For example, while there is a total of six named *Centistes* species in North America (Shaw 1985), there are at least eight undescribed *Centistes* species occurring in Costa Rica alone (Shaw unpublished data). While no *Centistes* species have been described from South America, one closely related species has recently been named in the genus *Centistoides* (van Achterberg 1992). *Centistes* can be identified to genus using the keys of Shaw (1985), van Achterberg (1985, 1992), or Marsh et al. (1987). The tribe Centistini is defined by Shaw (1985) and van Achterberg (1985, 1992). The subfamily Euphorinae is defined by Shaw (1985) and can be identified using the keys of Shaw and Huddleston (1991) or Goulet and Huber (1993).

Descriptive terminology follows that of Shaw (1985, 1993) and Marsh et al. (1987). Terminology for microsculpture follows that of Harris (1979). Wing venation terminology is that of Goulet and Huber (1993). Scanning electron microscopy was done with a JEOL model 35CF SEM at an operating voltage of 25 kv. Specimens from this study are deposited at the University of Wyoming, Rocky Mountain Systematic Entomology Laboratory, Laramie (RMSEL), the United States National Museum of Natural History, Washington, D.C. (USNM), the Universidade Federal de Sao Carlos, Sao Paulo, Brazil (UFSC), and EMBRAPA-CNPT, Passo Fundo, Rio Grande do Sul, Brazil.

Centistes gasseni Shaw,

NEW SPECIES

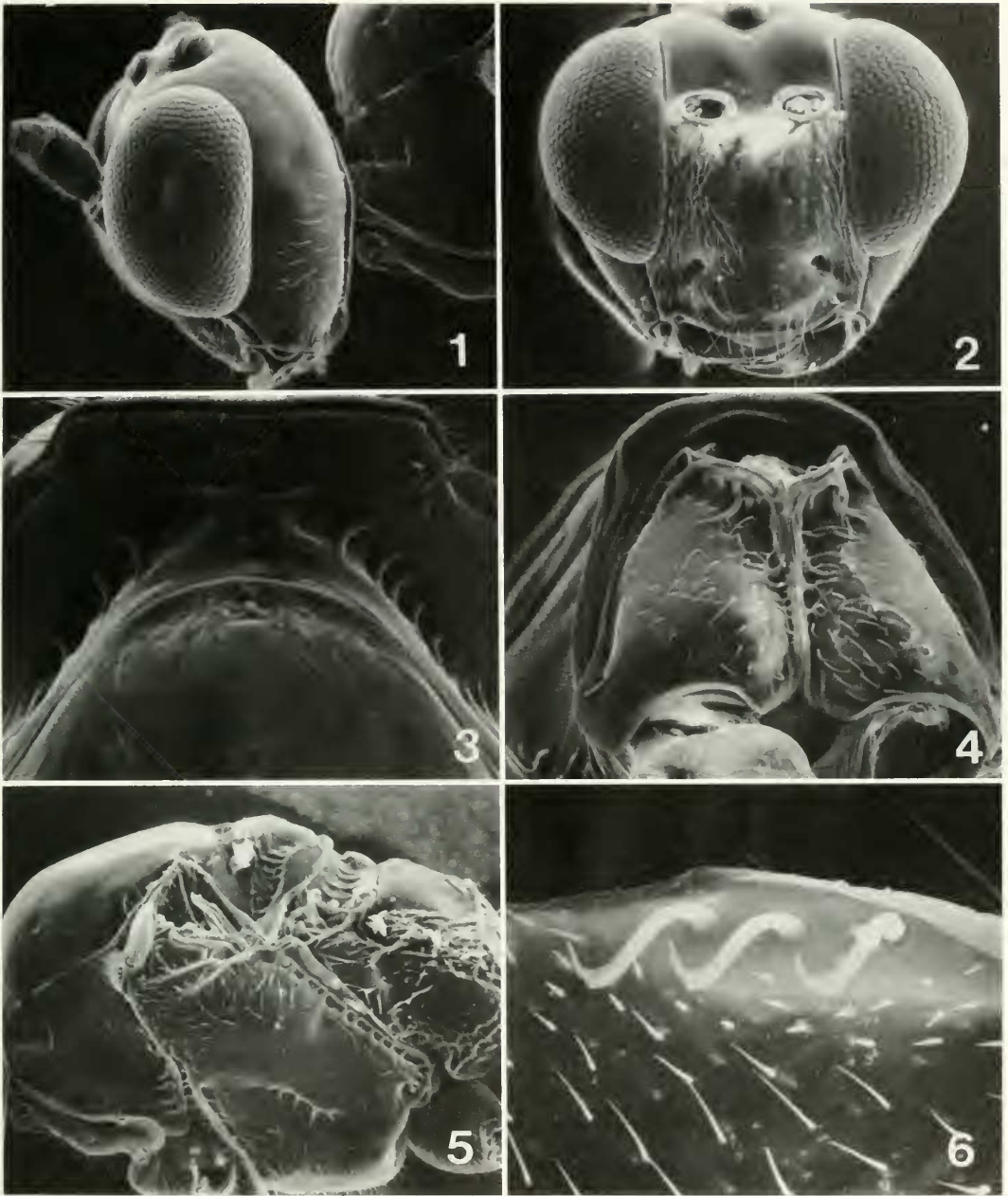
Figs. 1–18

Holotype female.—Body length 2.8 mm; forewing length 3.5 mm.

Head (Figs. 1, 2).—Shortest distance between eyes $1.28\times$ greater than clypeus width; face, clypeus, and gena evenly setose; frons, vertex, and temple smooth and devoid of setae; temple width $0.5\times$ eye width; eyes,

in anterior view, parallel and not converging ventrally; eye $1.61\times$ taller than wide, smooth, devoid of minute setae; scape cylindrical, $1.36\times$ longer than wide; pedicel compact, $0.88\times$ longer than wide; antenna with 26 flagellomeres; F1 $3.13\times$ longer than wide; F10 $2.86\times$ longer than wide; F26 $2\times$ longer than wide basally, terminating apically in a sharp point; malar space $0.22\times$ eye height, about equal to basal width of mandible; mandibles when closed overlapping for $0.6\times$ mandible length; mandible width basally $0.25\times$ mandible length, strongly narrowing apically; ocellar triangle equilateral, posterior margin of median ocellus slightly ahead of anterior margin of lateral ocellus; ocelli large, lateral ocellus separated from compound eye by distance $0.83\times$ ocellar width; occipital carina strong and complete, but situated very low on occiput, apex of occipital carina about level with midpoint of eye.

Mesosoma (Figs. 3–11).—With scattered large setae about same size as those on head posteriorly, except pronotum laterally, mesonotum, scutellum, central disc of mesopleuron, and dorsum of propodeum largely devoid of setae; pronotum rugose anteriorly, with a series of 5 shallow pronopes dorsomedially (Fig. 3); pronotal furrow foveate medially, smooth ventrally; prosterna with anterior and medial margins rugose, otherwise smooth, ending as smooth rounded flange over base of fore coxa (Fig. 4); mesonotum smooth, without any trace of notauli; mesopleuron mostly smooth, but with oblique foveate sternaulus and foveate posterior margin (Fig. 5); scutellar furrow bifoveate (Fig. 7); scutellar disc smooth; lateral subapical scutellar margins rugofoveolate; apex of scutellum minutely bifoveate; metanotum irregularly longitudinally costate, posterior rim narrow and smooth (Fig. 8); mesosternum anteriorly densely covered with erect setae; mesosternum and metasternum posteriorly obliquely costate (Fig. 11); propodeum clearly subdivided into anterior and posterior halves by a strong

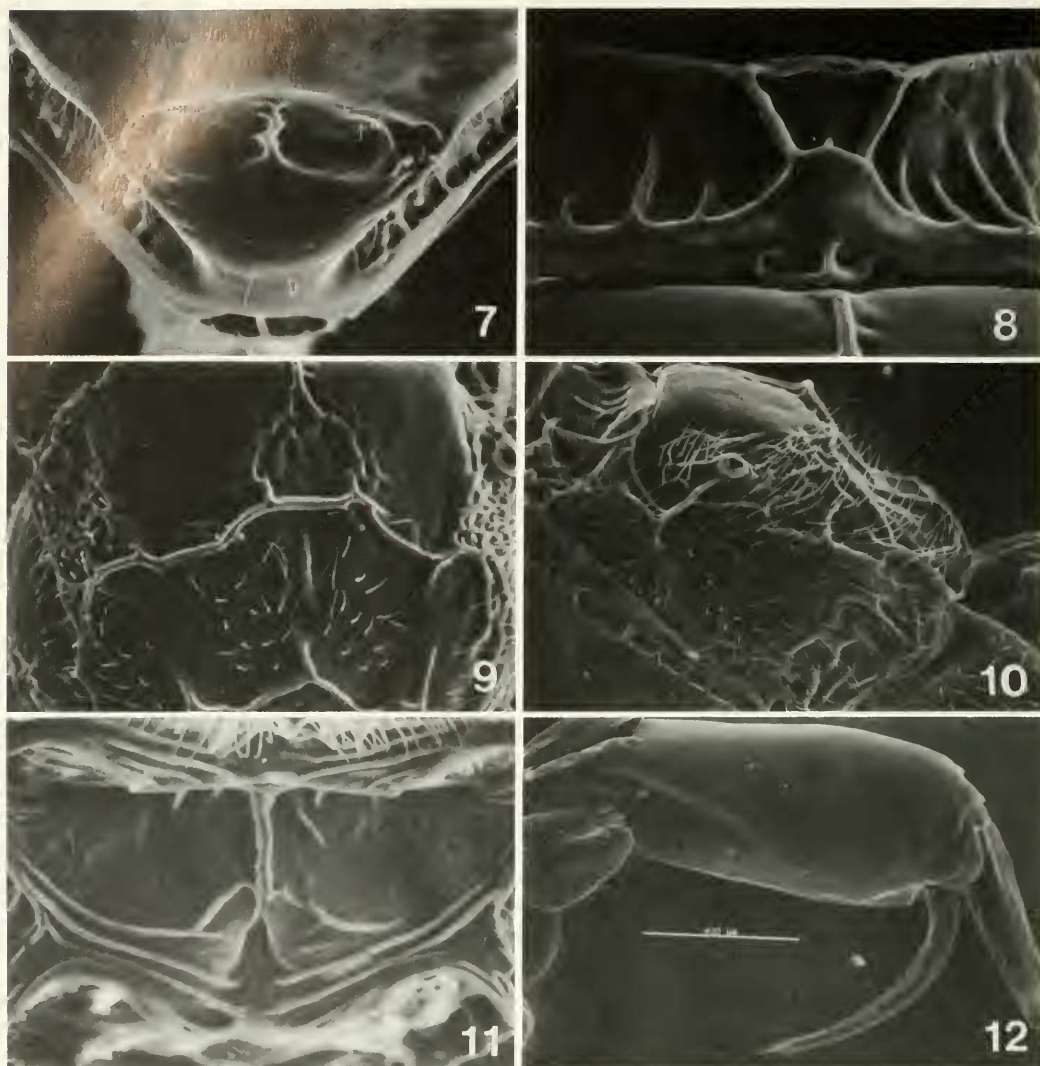


Figs. 1-6. *C. gasseni*. 1, Lateral view of head. 2, Anterior view of head. 3, Dorsal view of pronotum and anterior mesonotum. 4, Ventral view of pronotum, prosterna, and anterior coxal cavities. 5, Lateral view of mesosoma. 6, Dorsal view of anterior margin of hindwing and hamuli.

transverse carina, surfaces mostly smooth except medially and laterally rugulose (Figs. 9, 10).

Wings. — Venation as in Fig. 306 of Marsh

et al. (1987) except pterostigma $3.53\times$ longer than maximum width; r-rs vein $0.66\times$ as long as maximum width of pterostigma; length of marginal cell 2R1 along anterior

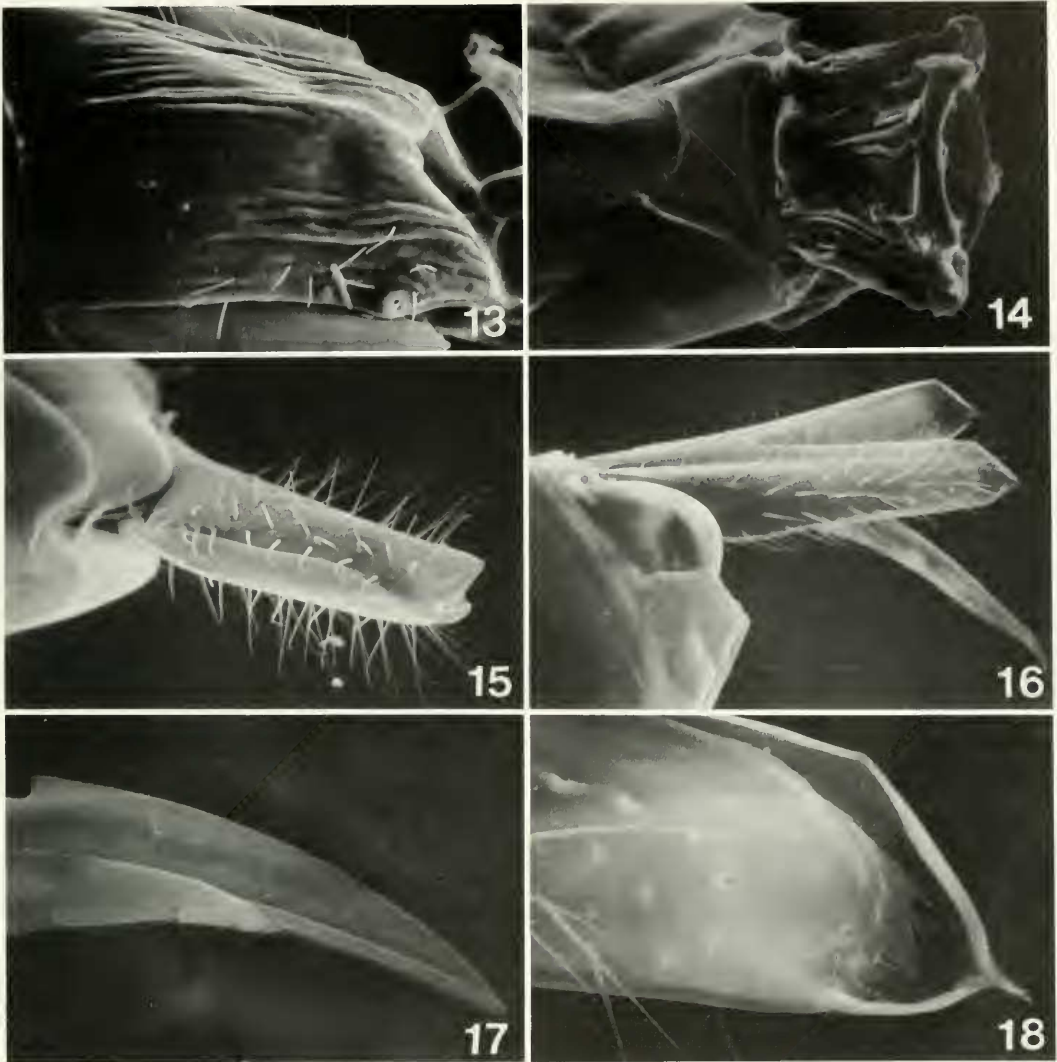


Figs. 7–12. *C. gasseni*. 7, Dorsal view of scutellum. 8, Dorsal view of metanotum. 9, Dorsal view of propodeum. 10, Lateral view of propodeum. 11, Ventral view of posterior mesosternum, metasternum, and associated coxal cavities. 12, Lateral view of metasoma.

wing margin equal to length of pterostigma; vein m-cu interstitial with vein Rs; vein M apically represented by a very short sclerotized stub; hindwing with 3 sinuate hamules (Fig. 12).

Legs.—Moderately setose throughout; surfaces smooth and shining, especially of coxae and femorae; coxae short and compact, fore and middle coxal lengths equal to

trochanter length; hind coxa longer, $1.8\times$ middle coxa length; hind femora length $5.4\times$ longer than maximum width; hind tibia length $9\times$ longer than maximum width, apical 30% moderately compressed in dorsal view; hind tibial spurs moderately long, $0.48\times$ as long as hind basitarsus; ratio of hind tarsomeres from basitarsus apically 48:26:22:16:24; tarsal claws large, simple.



Figs. 13–18. *C. gasseni*. 13, Dorsolateral view of first metasomal tergum. 14, Ventral view of first metasomal sternum. 15, Ventral view of apex of metasoma showing hypopygium and ovipositor sheaths with ovipositor retracted. 16, Lateral view of apex of metasoma showing hypopygium and ovipositor sheaths with ovipositor extended. 17, Lateral view of ovipositor apex. 18, Lateral view of ovipositor sheath apex.

Metasoma (Figs. 12–18).—Tergum I basally $0.63\times$ as wide as apical width, $1.7\times$ longer than apical width; spiracle of tergum I situated on lateral margin near basal quarter of segment; sculpture of tergum I longitudinally costate laterally, smooth medially and apically (Fig. 13); sternum I costate anteromedially, smooth posteriorly (Fig. 14); remainder of metasoma smooth and shin-

ing (Fig. 12); hypopygium deeply incised and laterally situated (Figs. 15, 16); ovipositor sheath short and broad, $3.2\times$ longer than basal width, densely setose (Figs. 15, 16), terminating in a sharp point formed from a fringe of dense setae (Fig. 18); dorsal and ventral edges of right ovipositor sheath wrapping over edges of left sheath; ovipositor smooth and saber-like, dorsal valve with

a deep subapical notch, ventral valve with 3 subapical curved incisions (Fig. 17).

Color.—Body bright orangish yellow except flagellum, compound eyes, ocelli, tips of tarsi, and ovipositor sheaths black; pedicel, mesonotum anteriorly and laterally, wing venation, apical $\frac{1}{3}$ of hind tibia, and remainder of hind tarsus dark brown; wing membrane infumated with light brown.

Variation.—Paratype females. Essentially as in holotype except body length 2.6–3.7 mm; forewing length 3.0–3.5 mm; 25–26 flagellomeres; color of compound eye varying from black to light gray; color of ocelli varying from black to light reddish brown; ocellar triangle varying from orange to dark brown or black; anterior and lateral mesonotal lobes varying from brown to black; ovipositor position varying from concealed to fully extended (as Fig. 12).

Paratype males.—As female except body length 2.6–3.5 mm; forewing length 2.5–3.0 mm; 24 flagellomeres; apex of metasoma from T3 beyond often infused with dark brown; parameres ovate with ventral margin somewhat flattened, orangish yellow, apically fringed with setae; aedeagus bilobate, smooth, yellowish white.

Host.—Originally reared from *Diabrotica speciosa* in Brazil. Reared in quarantine from the southern corn rootworm, *Diabrotica undecimpunctata howardi*.

Biology.—As far as known, all *Centistes* species are solitary koinobiont endoparasitoids of adult beetles, particularly the families Curculionidae, Chrysomelidae, Coccinellidae, Anthicidae, and Carabidae (Loan 1972, Shaw 1985). Only one other species, *Centistes (Syrhizus) diabroticae* (Gahan), is recorded as parasitizing adult stages of the subtribe Diabroticina (Gahan 1922). That species attacks the striped cucumber beetle, *Acalymma vittatum* (F.). The only other named neotropical species, *Centistes epicaeri* Muesebeck, parasitizes a curculionid on coffee (Muesebeck 1958). Some *Centistes* have been reported to leap onto the host elytra (Gahan 1922) or grasp the host beetle

with their legs during oviposition (Loan 1964, 1972). The dense layer of mesosternal setae in *Centistes gasseni* may be an adaptation to similar host-mounting behavior. More complete reviews of euphorine biology are given by Shaw (1988, 1994) and Shaw and Huddleston (1991).

Discussion.—*Centistes gasseni* is a very distinctive species because of its bright orangish yellow coloration, and should not be confused with any of the other known *Centistes* species. The only other described neotropical species, *C. epicaeri*, has an entirely black body, more coarsely costate tergum 1, and has the posterior face of the propodeum subdivided by a median carina that is absent in *C. gasseni*. The other undescribed *Centistes* species that I've seen from the neotropics all have mostly black body coloration, and are mostly smaller in size. The other species that parasitizes chrysomelids, *C. diabroticae* varies in body color from black to orangish yellow, but is somewhat smaller (2.2 mm), has a distinctive median fovea on the mesopleuron that is absent in *C. gasseni*, and has most of the Rs+M vein absent basally, thus the 1R1 and 1M cells are confluent (these cells are completely separated by the Rs+M vein in *C. gasseni*). *C. gasseni* can be distinguished from other known *Centistes* in the New World by the key given below. This key treats all of the named New World *Centistes* as reclassified by Shaw (1985).

Material examined.—Holotype: female, Brazil, Rio Grande do Sul, Passo Fundo, July 1991, D. N. Gassen, reared from *Diabrotica speciosa*, (RMSEL). Paratypes: 2 females, 2 males, same data as holotype; 30 females, 22 males, lab reared, United States, Maryland, Annapolis, Maryland Department of Agriculture quarantine facility, em. May 1, 1993, R. Schroder, reared from *Diabrotica undecimpunctata howardi*; 11 females, 149 males, same data except em. June–July 1993, (RMSEL, USNM, UFSC, EMBRAPA-CNPT).

Etymology.—Named for the collector of

the type series, Mr. Dirceu N. Gassen, of EMBRAPA-CNPT, Passo Fundo, Rio Grande do Sul, Brazil.

KEY TO THE NEW WORLD SPECIES OF
CENTISTES HALIDAY

- 1. Forewing vein Rs+M greatly reduced or absent, thus cells 1R1 and 1M forming a single large confluent cell; mesonotum smooth and without any trace of notauli (subgenus *Syr-rhizus*) 2
- Forewing vein Rs+M complete, thus cells 1R1 and 1M completely separated; mesonotum variable, but notauli often indicated, as least anteriorly, by a groove or foveation 3
- 2(1). Forewing vein Rs+M entirely absent; mesonotum entirely smooth, without any trace of sculpture; mesopleuron smooth, without any trace of a sternaulus; body black; parasitoids of Anthicidae (*Notoxus*); New York south to Virginia, westwards to Wyoming *Centistes agilus* (Cresson)
- Forewing vein Rs+M partly present apically, at least with a distinct stub; mesonotum with a distinctive median fovea, but otherwise smooth; mesopleuron with a small but distinct foveate sternaulus, but otherwise smooth; body color variable, but often extensively marked with reddish to yellowish brown; parasitoids of Chrysomelidae (*Acalymma*); central United States (Illinois, Ohio, Missouri) *Centistes diabroticae* (Gahan)
- 3(1). Notauli foveate and distinct throughout the length of the mesonotum; metasoma sometimes with small tooth-like structures situated on sternum 5 (subgenus *Ancylocentrus*) 4
- Notauli distinct only anteriorly, indicated by smooth grooves, or absent; metasoma smooth, without small tooth-like structures situated on sternum 5 (subgenus *Centistes*) 5
- 4(3). Small species 3 mm or less in body size; propodeum arcuate posteriorly; metasoma with small tooth-like structures situated on sternum 5; parasitoids of Curculionidae (*Sitona*); holarctic (northeastern Canada and Europe) *Centistes ater* (Nees) [= *C. excrucians* Haliday]
- Robust species 5 mm or greater in body size; propodeum coarsely rugose; metasoma without small tooth-like structures situated

- on sternum 5; parasitoids of Carabidae (*Amara*); eastern North America from Quebec south to Pennsylvania, westwards to South Dakota and Wyoming *Centistes laevis* (Cresson)
- 5(3). Body color mostly bright orangish yellow; ovipositor sheath terminating in a sharp point (Fig. 18); parasitoids of Chrysomelidae (*Diabrotica*); native to Brazil, introduced to the United States *Centistes gasseni* Shaw, NEW SPECIES
- Not as above; body color mostly black; ovipositor sheath blunt or rounded, not terminating in a sharp point 6
- 6(5). Mesonotum with notauli indicated by fine grooves; posterior face of the propodeum subdivided by a median carina; tergum 1 coarsely costate and nearly parallel-sided, only slightly wider posteriorly than basally; moderately large species 3-4 mm in body length; parasitoids of Curculionidae (*Epicauerus*) on coffee; El Salvador *Centistes epicaeri* Muesebeck
- Mesonotum smooth, notauli absent, posterior face of the propodeum not subdivided by a median carina; tergum 1 not so coarsely costate and about 1.5x wider posteriorly than basally; very small species 2 mm or less in body size; hosts unknown; central United States from Michigan south to Arkansas, Washington, D.C. westwards to Wyoming *Centistes claripennis* (Ashmead) [= *C. politus* (Ashmead)]

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